UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P O Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/525,058	09/06/2005	Christoph Brabec	15626-0048US1/SA-16US	5861

26161 7590 10/05/2009

FISH & RICHARDSON PC
P.O. BOX 1022
MINNEAPOLIS, MN 55440-1022

EXAMINER	
MOWLA, GOLAM	
ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
10/05/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATDOCTC@fr.com

Office Action Summary	Application No.	Applicant(s)	
	10/525,058	BRABEC ET AL.	
	Examiner	Art Unit	
	GOLAM MOWLA	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3,4,6,7,9-17,20-25,27,28 and 30-53* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3,4,6,7,9-17,20-25,27,28 and 30-53* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *06/19/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

FINAL ACTION

Response to Amendment

1. Applicant's amendment of 07/08/2009 does not place the Application in condition for allowance.

2. Claims 1, 3, 4, 6, 7, 9-17 and 20-25, 27, 28, and 30-53 are currently pending. Applicants amended claims 1, 4, 7, 16, 23, 36, 38 and 40, cancelled claims 2, 8, 26 and 29, and added new claims 50-53.

3. The amendment filed 07/08/2009 is objected to under 35 U.S.C. 132(a) because it introduces new matter into the disclosure. 35 U.S.C. 132(a) states that no amendment shall introduce new matter into the disclosure of the invention. The added material which is not supported by the original disclosure is as follows: Claim 52 recites the limitation "the organic photovoltaic cell is configured so that, during use, light passes through the substrate prior to reaching the organic semiconductor layer" which is not supported by the original disclosure as filed. Applicant is requested to provide support for this limitation in the claim.

Applicant is required to cancel the new matter in the reply to this Office Action.

Status of the Objections or Rejections

4. Due to Applicant's amendment of claims 1, 4, 7, 16, 23, 36, 38 and 40, all rejections from the office Action dated on 04/13/2009 are withdrawn. However, upon further consideration, a new ground(s) of rejection is/are presented below.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 52-53 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claim 52 recites the limitation "the organic photovoltaic cell is configured so that, during use, light passes through the substrate prior to reaching the organic semiconductor layer" which is not supported by the original disclosure as filed. Applicant is requested to provide support for this limitation in the claim.

Claim Rejections - 35 USC § 103

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 1, 3-4, 6-7, 9, 10, 12-15, 21, 23-25, 27-28, 30-43 and 45-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizuno (US 6350945) in view of Shaheen et al. (WO/2001/084644, refer to US 2003/0159729 A1 for English equivalence), and further in view of Shinohara et al. (US 5891264). Supporting evidence is provided by Peterson (US 4195121).

Regarding claim 1, Mizuno discloses a photovoltaic component (see col. 1, lines 12-16, col. 3, line 50 to col. 4, line 44; see also fig. 2), comprising:

- a substrate (14 and 15) having a first surface (top surface of 15 touching layer 16) and a second surface (bottom surface of 14) opposite the first surface (top surface), the first surface (top surface of 15 touching layer 16) of the substrate (14 and 15) being a structured surface (see fig. 2),
- a photovoltaic component (solar cell 10; fig. 2) having a first and second electrodes and a semiconductor layer (inherent features of a solar cell).

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer having a conjugated polymer and an acceptor.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Mizuno in view of Shaheen further teaches that polymeric portion of the substrate (14) is flexible (4:9-14). However the reference is silent as to whether the Al portion of the substrate (15) is flexible to form the flexible sheet.

Shinohara discloses a substrate (201+202) for a photovoltaic component wherein the substrate is made of a flexible sheet (flexible PET polymer combined with flexible Al film containing 1% of Si) (5: 58-67; 7:30-39; 7:46-50; 8:28-36; 8:66 to 9:4) (see also fig. 7) (see US Patent 4,195,121 to Peterson which shows on col. 3, lines 17-37 that Al film with thickness of 0.005-0.064 cm or 50-640 μm is flexible, and since the Al-Si 1wt% film of Shinohara has the thickness around 0.2 to 2 μm, the film of Shinohara is flexible).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible Al-Si 1wt% film having a thickness 1 μm of Shinohara as the diffraction grating of Mizuno in the photovoltaic component of Mizuno in view of Shaheen in order to optimize the diffuse reflectance percentage as taught by Shinohara (see fig. 7 of Shinohara which shows the diffuse reflectance percentage is optimized with Al-Si 1wt% film thickness being around 1 μm).

Regarding claim 3, Mizuno in view of Shaheen further discloses an additional layer (16) between the substrate (14 and 15) and the first electrode (electrode 3 of Shaheen), the additional layer (16) having a surface (lower surface) that is structured.

Regarding claim 4, Mizuno discloses a method comprising:

- providing a photovoltaic component (solar cell 10; see col. 1, lines 12-16, col. 3, line 50 to col. 4, line 44; see also fig. 2), comprising:

- a substrate (14 and 15) having a first surface (top surface of 15 touching layer 16) and a second surface (bottom surface of layer 14) opposite the first surface (top surface of layer 15 touching layer 16), the first surface (top surface of layer 15 touching layer 16) of the substrate (14 and 15) being a structured surface (see fig. 2), and
- a photovoltaic component (solar cell 10; fig. 2) having a first and second electrodes and a semiconductor layer (inherent features of a solar cell).

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer having a conjugated polymer and an acceptor.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Mizuno further teaches that polymeric portion of the substrate (14) is flexible (4:9-14). However the reference is silent as to whether the Al portion of the substrate (15) is flexible to form the flexible sheet.

Shinohara discloses a substrate (201+202) for a photovoltaic component wherein the substrate is made of a flexible sheet (flexible PET polymer combined with flexible Al film containing 1% of Si) (5: 58-67; 7:30-39; 7:46-50; 8:28-36; 8:66 to 9:4) (see also fig. 7) (see US 4195121 to Peterson which shows in col. 3, lines 17-37 that Al film with thickness of 0.005-0.064 cm or 50-640 μm is flexible; since the Al-Si 1wt% film thickness of Shinohara is 0.2 to 2 μm, the film of Shinohara is ultra-flexible).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible Al-Si 1wt% film having a thickness 1 μm of Shinohara as the diffraction grating of Mizuno in the photovoltaic component of Mizuno in view of Shaheen in order to optimize the diffuse reflectance percentage as taught by Shinohara (see fig. 7 of Shinohara which shows the diffuse reflectance percentage is optimized with Al-Si 1wt% film thickness being around 1 μm).

Regarding claim 6, Mizuno in view of Shaheen further discloses an additional layer (16) on the structured surface (top surface of 15) of the substrate (14 and 15) so that the additional layer (16) has a structured surface (lower surface) that supports the semiconductor layer (layer 5 of Shaheen).

Regarding claim 7, Mizuno discloses a photovoltaic component (see col. 1, lines 12-16, col. 3, line 50 to col. 4, line 44; see also fig. 2), comprising:

- a substrate (14 and 15) having a first surface (top surface of 15) and a second surface (bottom surface of 14) opposite the first surface (top surface of 15), the first surface (top surface of 15) of the substrate (14 and 15) being a structured surface (see fig. 2), and
- a photovoltaic component (solar cell 10; fig. 2) having a first and second electrodes and a semiconductor layer (inherent features of a solar cell).

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Mizuno further teaches that polymeric portion of the substrate (14) is flexible (4:9-14). However the reference is silent as to whether the Al portion of the substrate (15) is flexible to form the flexible sheet.

Shinohara discloses a substrate (201+202) for a photovoltaic component wherein the substrate is made of a flexible sheet (flexible PET polymer combined with flexible Al film containing 1% of Si) (5: 58-67; 7:30-39; 7:46-50; 8:28-36; 8:66 to 9:4) (see also fig. 7) (see US 4195121 to Peterson which shows in col. 3, lines 17-37 that Al film with thickness of 0.005-0.064 cm or 50-640 μm is flexible; since the Al-Si 1wt% film thickness of Shinohara is 0.2 to 2 μm, the film of Shinohara is ultra-flexible).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible Al-Si 1wt% film having a thickness 1 μm of Shinohara as the diffraction grating of Mizuno in the photovoltaic component of Mizuno in view of Shaheen in order to optimize the diffuse reflectance percentage as taught by Shinohara (see fig. 7 of Shinohara which shows the diffuse reflectance percentage is optimized with Al-Si 1wt% film thickness being around 1 μm).

Regarding claim 9, Mizuno in view of Shaheen further discloses that a surface of the semiconductor is planar (see fig. 1 of Shaheen).

Regarding claim 10, Mizuno in view of Shaheen further discloses that the first electrode (electrode 6 of Shaheen) is disposed on the first surface (top surface of 15) of the substrate (14 and 15).

Regarding claim 12, Mizuno in view of Shaheen further discloses a planarized layer (17) between the substrate (14 and 15) and the first electrode (electrode 3 of Shaheen).

Regarding claim 13, Mizuno in view of Shaheen further discloses the first electrode (electrode 6 of Shaheen) is disposed on a planarized surface (top surface) of the planarized layer (17 of Mizuno) (see fig. 1 of Shaheen).

Regarding claim 14, Mizuno in view of Shaheen further discloses a planarized layer (barrier layer 8, ¶ 0069; see fig. 7 that shows the barrier layer is planarized) between the organic semiconductor (layer 4 of Shaheen) and the first electrode (layer 6 of Shaheen).

Regarding claim 15, Mizuno in view of Shaheen further discloses that the first electrode (layer 6 of Shaheen) is disposed on the substrate (14 and 15 of Mizuno).

Regarding claim 21, Mizuno in view of Shaheen further discloses that the acceptor comprises a fullerene ([0011] of Shaheen).

Regarding claim 23, Mizuno discloses a photovoltaic component (see col. 1, lines 12-16, col. 3, line 50 to col. 4, line 44; see also fig. 2), comprising:

- a polymeric substrate (14 and 15) having a first surface (top surface of 15 touching layer 16) and a second surface (bottom surface of 14) opposite the first surface (top surface), the first surface (top surface of 15 touching layer 16) of the substrate (14 and 15) being a structured surface (see fig. 2);
- a support layer (16) having a surface (top or bottom surface) (see fig. 2) and
- a first electrode (solar cell 10 inherently has two electrodes - anode and cathode; in this case the first electrode would be the one touching layer

17), the support layer (16) being between the substrate (15) and the first electrode;

- a second electrode (solar cell 10 inherently has two electrodes - anode and cathode; in this case the second electrode would be the opposite the first electrode which touches layer 17);
- a semiconductor layer between the first and second electrodes ((solar cell 10 has a semiconductor layer between anode and cathode),
    - wherein the first electrode is between the support layer (16) and the semiconductor.

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer with a planar surface having conjugated polymer and an acceptor.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) with a planar surface (fig. 1) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Mizuno further teaches that polymeric portion of the substrate (14) is flexible (4:9-14). However the reference is silent as to whether the Al portion of the substrate (15) is flexible to form the flexible sheet.

Shinohara discloses a substrate (201+202) for a photovoltaic component wherein the substrate is made of a flexible sheet (flexible PET polymer combined with flexible Al film containing 1% of Si) (5: 58-67; 7:30-39; 7:46-50; 8:28-36; 8:66 to 9:4) (see also fig. 7) (see US 4195121 to Peterson which shows in col. 3, lines 17-37 that Al film with thickness of 0.005-0.064 cm or 50-640 μm is flexible; since the Al-Si 1wt% film thickness of Shinohara is 0.2 to 2 μm, the film of Shinohara is ultra-flexible).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible Al-Si 1wt% film having a thickness 1 μm of Shinohara as the diffraction grating of Mizuno in the photovoltaic component of Mizuno in view of Shaheen in order to optimize the diffuse reflectance percentage as taught by Shinohara (see fig. 7 of Shinohara which shows the diffuse reflectance percentage is optimized with Al-Si 1wt% film thickness being around 1 μm).

Regarding claim 24, Mizuno further discloses that the surface (bottom surface) of the support layer (16) is structured (see fig. 2).

Regarding claim 25, Mizuno further discloses that the surface (top surface of 15) of the substrate (14 and 15) is structured.

Regarding claim 27, Mizuno further discloses that the surface (top surface) of the support layer (16) is planar.

Regarding claim 28, Mizuno further discloses that the first surface (top surface) of the substrate (15) has a periodic structure (see fig. 2 and 10).

Regarding claim 30, Mizuno in view of Shaheen further discloses an additional layer (16) between the substrate (14 and 15) and the first electrode (electrode 3 of Shaheen), the additional layer (16) having a surface (bottom surface) that is structured.

Regarding claims 31-33, Mizuno further discloses that the first/structured surface (top surface) of the substrate (14 and 15) has a periodic structure (see fig. 2 and 10).

Regarding claim 34, Mizuno further discloses that the periodic structure (structure of top surface of 15) of the substrate (14 and 15) is configured to impart light trapping during use of the organic photovoltaic component (see fig. 10). Examiner also

notes that the functional limitation "to impart light trapping during use of the organic photovoltaic component" does not add any structural limitation to the product, and therefore has not been given any patentable weight.

Regarding claim 35, Mizuno further discloses that the structured surface (bottom surface) of the support layer (16) has a periodic structure (see fig. 2 and 10).

Regarding claims 36 and 40, Mizuno discloses a photovoltaic component (see col. 1, lines 12-16, col. 3, line 50 to col. 4, line 44; see also fig. 2), comprising:

- a substrate (15) having a surface with a periodic structure (see fig. 2 and 10) and
- a photovoltaic component (solar cell 10; fig. 2) having a first and second electrodes and a semiconductor layer (inherent features of a solar cell).

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer with a planar surface having conjugated polymer and an acceptor.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) with a planar surface (fig. 1) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Mizuno further teaches that polymeric portion of the substrate (14) is flexible (4:9-14). However the reference is silent as to whether the Al portion of the substrate (15) is flexible to form the flexible sheet.

Shinohara discloses a substrate (201+202) for a photovoltaic component wherein the substrate is made of a flexible sheet (flexible PET polymer combined with flexible Al film containing 1% of Si) (5: 58-67; 7:30-39; 7:46-50; 8:28-36; 8:66 to 9:4) (see also fig. 7) (see US 4195121 to Peterson which shows in col. 3, lines 17-37 that Al film with thickness of 0.005-0.064 cm or 50-640 μm is flexible; since the Al-Si 1wt% film thickness of Shinohara is 0.2 to 2 μm, the film of Shinohara is ultra-flexible).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible Al-Si 1wt% film having a thickness 1 μm of Shinohara as the diffraction grating of Mizuno in the photovoltaic component of Mizuno in view of Shaheen in order to optimize the diffuse reflectance percentage as taught by Shinohara (see fig. 7 of Shinohara which shows the diffuse reflectance percentage is optimized with Al-Si 1wt% film thickness being around 1 μm).

Regarding claims 37 and 41, Mizuno further discloses that the periodic structure of the substrate (15) is configured to impart light trapping during use of the organic photovoltaic component (see fig. 10). Examiner also notes that the functional limitation "to impart light trapping during use of the organic photovoltaic component" does not add

any structural limitation to the product, and therefore has not been given any patentable weight.

Regarding claim 38, Mizuno discloses a method comprising:

- providing a photovoltaic component (solar cell 10; see col. 1, lines 12-16, col. 3, line 50 to col. 4, line 44; see also fig. 2), comprising:
  - a substrate (15) having a surface (top surface) that is periodically structured (see fig. 2) and
  - a photovoltaic component (solar cell 10; fig. 2) having a first and second electrodes and a semiconductor layer (inherent features of a solar cell).

Although Mizuno discloses that the photovoltaic component (10) can be organic photovoltaic component (see col. 1, lines 12-16), the reference does not explicitly disclose the use of an organic photovoltaic component comprising an organic semiconductor layer with a planar surface having conjugated polymer and an acceptor.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) with a planar surface (fig. 1) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic photovoltaic component of Shaheen in place of solar cell of Mizuno to allow for increased short-circuit current, as shown by Shaheen.

Mizuno further teaches that polymeric portion of the substrate (14) is flexible (4:9-14). However the reference is silent as to whether the Al portion of the substrate (15) is flexible to form the flexible sheet.

Shinohara discloses a substrate (201+202) for a photovoltaic component wherein the substrate is made of a flexible sheet (flexible PET polymer combined with flexible Al film containing 1% of Si) (5: 58-67; 7:30-39; 7:46-50; 8:28-36; 8:66 to 9:4) (see also fig. 7) (see US 4195121 to Peterson which shows in col. 3, lines 17-37 that Al film with thickness of 0.005-0.064 cm or 50-640 μm is flexible; since the Al-Si 1wt% film thickness of Shinohara is 0.2 to 2 μm, the film of Shinohara is ultra-flexible).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible Al-Si 1wt% film having a thickness 1 μm of Shinohara as the diffraction grating of Mizuno in the photovoltaic component of Mizuno in view of Shaheen in order to optimize the diffuse reflectance percentage as taught by Shinohara (see fig. 7 of Shinohara which shows the diffuse reflectance percentage is optimized with Al-Si 1wt% film thickness being around 1 μm).

Regarding claim 39, Mizuno further discloses that the structure of the substrate (15) is configured to impart light trapping during use of the organic photovoltaic component (see fig. 10). Examiner also notes that the functional limitation "to impart light trapping during use of the organic photovoltaic component" does not add any

structural limitation to the product, and therefore has not been given any patentable weight.

Regarding claims 42-43 and 45-49, Mizuno in view of Shaheen further discloses that the organic semiconductor layer (layer 4 of Shaheen) comprises a conjugated polymer and a fullerene acceptor ([0011] of Shaheen).

Regarding claims 50-53, Mizuno in view of Shaheen and Shinohara further discloses that the substrate comprises PET (4:9-15 of Mizuno, and 7:34-39 of Shinohara). Examiner notes that the limitation "the organic photovoltaic cell is configured so that, during use, light passes through the substrate prior to reaching the organic semiconductor layer" does not add any structural limitation to the product, and therefore has not been given any patentable weight.

9. Claims 1, 4, 7, 9-11, 16-17, 20, 22 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shaheen in view of Iida et al. (US 4510195).

Regarding claims 1, 4, 7, 9-11, 16-17, 20, 22 and 44, Shaheen discloses a photovoltaic cell (fig. 1, [0002-0014]), or a method of providing an organic photovoltaic cell (fig. 1, [0002-0014]), comprising:

- a substrate (transparent glass carrier 1);
- a first electrode (smoothing layer 3);
- a first layer (electrode layer 2), the first layer (2) being between the substrate (1) and the first electrode (3);
- a second layer (intermediate layer 5),;
- a second electrode (electron collecting electrode 6); and

- an organic semiconductor layer (photoactive layer 4) having a conjugated polymer and an acceptor ([0011]), the organic semiconductor (4) is between first (3) and second (6) electrodes;
    - wherein the second layer (5) is between the first electrode (3) and the organic semiconductor (4), the bottom surface of the first electrode (3) is structured ([0010]) (bottom surface of layer 3 is structured as it is formed on the rough structured surface of layer 2, [0010]) and top surface is planar ([0010]) (as its function was to smooth the rough surface, therefore the top surface is inherently planar), a surface of the first layer (3) is structured (top surface of layer 2 is structured) ([0010]), a surface (top or bottom) of the second layer (5) is planar, and a surface (top or bottom) of the organic semiconductor (4) is planar (see fig. 9).

However, Shaheen is silent as to whether the substrate is flexible and structured.

Iida teaches a flexible, glass-covered substrate (S, fig. 2, col. 1, line 66 to col. 3, line 68) wherein a surface of the substrate is structured (col. 3, lines 18-20) such that the flexible substrate has less tendency toward breakage even when external force is applied (col. 1, lines 49-52).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible, glass-covered substrate of Iida in the photovoltaic cell of Shaheen, because the flexible substrate of Iida has less tendency toward breakage even when external force is applied (col. 1, lines 49-52).

10. Claims 1, 4, 7, 9-11, 16-17, 20, 22 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujimori in view of Iida et al. (US 4510195), and further in view of Shaheen.

Regarding claims 1, 4, 7, 9-11, 16-17, 20, 22 and 44, Shaheen discloses a photovoltaic cell, or a method of providing an organic photovoltaic cell (see figures and [0066-0249]), comprising:

- a substrate (2);
- a first electrode (transparent electrode, [0082]);
- a first layer (comb-teeth-like electrode, [0082]), the first layer (comb-teeth-like electrode) being between the substrate (2) and the first electrode (transparent electrode);
- a second layer (barrier layer 8);
- a second electrode (6); and
- an semiconductor layer (electron transport layer 4) between first (transparent electrode) and second (6) electrodes;
    - wherein the second layer (8) is between the first electrode (transparent electrode, [0082]) and the semiconductor (4); the bottom surface of the first electrode (transparent electrode) is structured ([0082]) (bottom surface of transparent electrode is structured as it is formed on the rough structured surface of comb-teeth-like electrode, [0082]) and top surface is planar ([0082]) (as the transparent electrodes smooth the comb-teeth-like bottom

surface, therefore the top surface is inherently planar), a surface of the first layer (comb-teeth-like electrode) is structured (top surface of comb-teeth-like electrode is structured) ([0082]), a surface of the second layer (8) is planar (top surface), and a surface of the semiconductor (4) is planar (top or bottom) (see figures).

However, Fujimori is silent as to whether the substrate is flexible and structured.

Iida teaches a flexible, glass-covered substrate (S, fig. 2, col. 1, line 66 to col. 3, line 68) wherein a surface of the substrate is structured (col. 3, lines 18-20) such that the flexible substrate has less tendency toward breakage even when external force is applied (col. 1, lines 49-52).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible, glass-covered substrate of Iida in the photovoltaic cell of Fujimori, because the flexible substrate of Iida has less tendency toward breakage even when external force is applied (col. 1, lines 49-52).

The references do not explicitly disclose whether the semiconductor layer is an organic semiconductor layer and comprises a conjugated polymer and an acceptor.

Shaheen discloses an organic photovoltaic component (fig. 1) ([0010-0014])) comprising of a first electrode (electrode 6) that has a planar surface (fig. 1), an organic semiconductor layer (photoactive layer 4) with a planar surface (fig. 1) having a conjugated polymer and an acceptor ([0011]), and a second electrode (electrode layer 2), the organic semiconductor layer (4) being between the first electrode (6) and second electrode (2) allows for a device with improved short-circuit current ([0003] and [0005]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the organic semiconductor of Shaheen in the photovoltaic cell of Fujimori it allow for a device with improved short-circuit current, as shown by Shaheen.

11. Claims 1, 4, 7, 11 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kambe et al. (US 5986206) in view of Bloch et al. (US 4683160), and further in view of Nakamura (US 6291763).

Regarding claims 1, 7 and 11, Kambe discloses a photovoltaic cell (100) (fig. 1, col. 3, lines 18-50), comprising:

- a substrate (substrate support in contact with electrode 110) having a first surface (top surface which contacts electrode 110) and a second surface (bottom surface) opposite the first surface (top surface);
- a first electrode (electrode 110) with a planar surface (top surface) (see fig. 1), the first electrode (110) being a cathode (col. 6, lines 15-27), the first electrode (110) being closer to the first surface (top surface) of the substrate than the second surface (bottom surface) of the substrate (substrate support),
- an organic semiconductor layer comprising a conjugated polymer and an acceptor (donor/acceptor composite) (col. 5, lines 2-35), the first electrode being between the substrate (substrate support) and the organic semiconductor layer (102+104), and,

- a second electrode (electrode 112), the organic semiconductor (102+104) between the first (110) and second (112) electrodes.

However, Shinohara is silent as to whether the first surface of the substrate is structured.

Bloch teaches a solar cell with correlated roughness substrate (4) to increase the light absorption within the film of the incident light.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the structured substrate of Bloch in the photovoltaic component of Kambe to increase the light absorption within the film of the incident light, as taught by Bloch.

The references however are silent as to whether the substrate is flexible.

Nakamura teaches an organic photovoltaic component (fig. 2B and col. 29, lines 49-54) wherein the substrate (13) is made of flexible sheet (col. 31, lines 41-45) to allow for highly productive production process (col. 31, lines 41-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible substrate of Nakamura in the organic photovoltaic component of Kambe in view of Bloch to allow for highly productive production process, as shown by Nakamura.

Regarding claim 22, Kambe in view of Bloch further discloses that the first electrode (110) has a structured surface (bottom surface is structured).

Regarding claim 4, Kambe discloses a method comprising an organic photovoltaic component (solar cell 100) (fig. 1, col. 3, lines 18-50), comprising:

- a substrate (substrate support in contact with electrode 110) having a first surface (top surface which contacts electrode 110) and a second (bottom surface) surface opposite the first surface (top surface);
- a first electrode (electrode 110) with a planar surface (top surface) (see fig. 1), the first electrode (110) being closer to the first surface (top surface) of the substrate than the second surface (bottom surface) of the substrate (substrate support),
- an organic semiconductor layer comprising a conjugated polymer and an acceptor (donor/acceptor composite) (col. 5, lines 2-35), the first electrode being between the substrate (substrate support) and the organic semiconductor layer (102+104), and,
- a second electrode (electrode 112), the organic semiconductor (102+104) between the first (110) and second (112) electrodes.

However, Shinohara is silent as to whether the first surface of the substrate is structured.

Bloch teaches a solar cell with correlated roughness substrate (4) to increase the light absorption within the film of the incident light.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the structured substrate of Bloch in the photovoltaic component of Kambe to increase the light absorption within the film of the incident light, as taught by Bloch.

The references however are silent as to whether the substrate is flexible.

Nakamura teaches an organic photovoltaic component (fig. 2B and col. 29, lines 49-54) wherein the substrate (13) is made of flexible sheet (col. 31, lines 41-45) to allow for highly productive production process (col. 31, lines 41-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have utilized the flexible substrate of Nakamura in the organic photovoltaic component of Kambe in view of Bloch to allow for highly productive production process, as shown by Nakamura.

Response to Arguments

12. Applicant's arguments with respect to claims 1, 3, 4, 6, 7, 9-17 and 20-25, 27, 28, and 30-53 have been considered but are moot in view of the new ground(s) of rejection as necessitated by the amendments.

With respect to the independent claims 1, 4, 7, 16, 23, 36, 38 and 40, Applicant argues that Neither Mizuno nor Shaheen, alone or in combination, discloses or suggests such a substrate, and it would not have been obvious (or perhaps even possible) to combine these references to provide such a substrate (see Remarks).

This argument is persuasive and is moot in view of new ground of rejection as presented above.

Applicant also argues that as amended, claim 1 requires a substrate that is a structured, flexible sheet. None of Kambe, Bloch or Nakamura disclose such a substrate, and it would not have been obvious to combine these references to provide such a substrate. For example, while Bloch discloses a textured active layer of semiconductor material (see, e.g., Bloch, col. 2, lines 5-8), he does not disclose a

substrate that is a structured, flexible sheet. Nor would it have been obvious to modify Bloch to provide such a substrate. Neither Kambe nor Nakamura, alone or in combination, cure this deficiency. Thus, even if Kambe, Bloch and Nakamura were combined in the manner indicated by the Examiner, the result would not be the subject matter covered by claim 1, as presented (see Remarks).

The Examiner respectfully disagrees. Examiner notes that that the bottom surface of the semiconductor layer (2) of Bloch is also the top surface of the substrate (4) of Bloch and in fig. 1 Bloch explicitly shows that the top surface of the semiconductor film is structured.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Correspondence/Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to GOLAM MOWLA whose telephone number is (571) 270-5268. The examiner can normally be reached on M-F, 0900-1700 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ALEXA NECKEL can be reached on (571) 272-1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/G. M./
Examiner, Art Unit 1795

/Jennifer K. Michener/
Supervisory Patent Examiner, Art Unit 1795